Individually quick frozen Blueberries

Agricultural Processing Brochure

South African farmers facing current economic realities are searching for new options to maintain and expand their businesses. One of the many opportunities to grow markets, turnover and profits is by adding value to farm produce. Options need to be selected carefully based on sound information and knowledge of the opportunities presenting themselves.

Please note the **Disclaimer** on page 6

Brochure content

"Fresh blueberries are individually quick frozen (IQF) to give the perception of fresh fruit."

Introduction

Product group: Blueberries

Blueberry is the common name of the genus *Vaccinium* in the heath family, *Ericaceae.* Various species of blueberries exist, varying from shrubs less than 0.3 m tall to large bushes more than 5 m in height. The sweet-tasting berry contains 40 to 50 small, soft seeds and often has a powdery coating. Most blueberry species are indigenous to North America, where 90% of the blueberries in the world are produced.

Blueberries mature two to three months after flowering and are harvested throughout the summer season when the solids content is approximately 15%. Blueberries are mainly consumed fresh, but can also be used for cake toppings, pie fillings and baked products. Other processing options include juicing, concentrating, jam and jelly cooking.

Product description: IQF blueberries

Fresh blueberries are individually quick frozen (IQF) to produce a product that maintains its individual identity and gives the perception of "fresh fruit". This makes it ideal for inclusion in muffins and other bakery products as well as fillings. Frozen berries can also be used in salads, fruit cocktails and breakfast cereals or as mixtures with other IQF berries. The IQF method is used since it preserves the cell structure, texture, colour, flavour and aroma of the berries best.

Process description:

Harvesting of blueberries

Blueberries are picked manually or mechanically when the berries reach the soft ripe stage and a solids content of around 15%, since flavour and aroma development is of prime importance to the end product. This requires a harvesting method that damages the product least. The berries may be picked by hand and placed in flat trays for transport and/or further processing. However, with the improved cultivars that ripen more uniformly and the advanced technology of harvesters, mechanical harvesting has become a more viable option for large producers and processors.

It is advisable to harvest berries in the early morning to eliminate or at least reduce the need for additional cooling. The time between harvesting and processing should be kept to a minimum and the harvested product needs to be handled with great care at all stages prior to processing.

Field sorting and trimming of blueberries

Mechanically harvested berries often contain excessive amounts of plant material and other impurities. This should be removed in the field or before delivery to the processing plant to reduce waste loads.

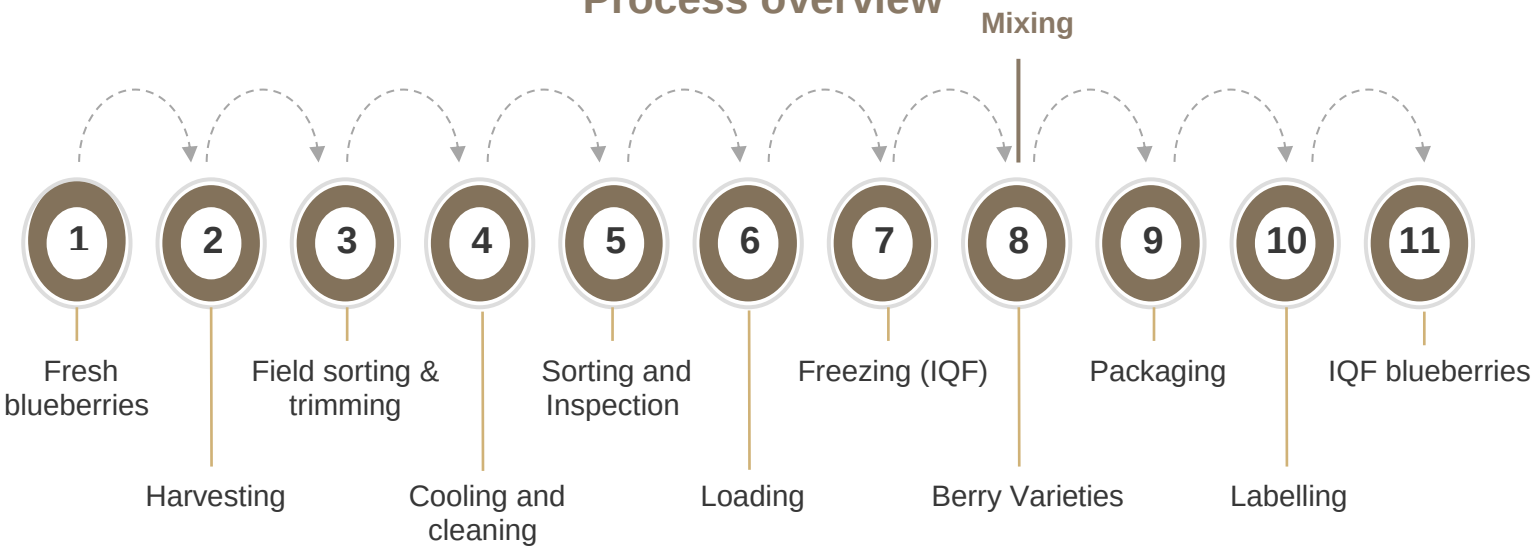
The freshly harvested berries are sorted and trimmed on sorting tables with the help of separation screens to remove defective fruits, any remaining plant material and foreign materials such as stones. Trimming and sorting is usually done manually while destemming can be performed mechanically by passing the berries through soft rubber-coated rollers.

Cooling and cleaning of blueberries

The berries must be cooled to between 0 - 5 °C as soon as possible after harvesting and kept at this temperature range until processing starts. Hydrocooling is the most effective method to achieve rapid cooling. Water has the advantage of acting as a cooling, cleaning and transportation medium.

The trays of berries are dumped gently into a tank containing cold, potable water (0 - 5 °C). The water acts as a cushion against any possible mechanical damage, while cooling and cleaning the berries. The berries are transported by the water via a trough or closed pipe from the tank to a vibrating, sloping riddle or screen on which it is sprayed with potable water to complete the cooling and cleaning process.

Process overview



From here the clean berries are delivered to the sorting tables/belts via perforated racks/conveyors that also allow draining of cleaning water. The cleaning water may be recirculated after filtration and treatment.

Although forced air cooling can be used instead of hydrocooling, it requires additional cleaning (aspiration and screening) steps to remove foreign matter. The trays of berries are placed in a chamber where chilled air is drawn into the cold room through the trays. The temperature of the fruit must decrease to between 2 - 4 °C within 1 hour of harvesting.

Berry fruits are not usually washed, unless they contain significant impurities, in which case washing is performed by passing the fruit on belts under low-pressure water sprayers.

Sorting and inspection of blueberries

This is done to select the best suitable raw materials for manufacturing the value-added end product. The clean blueberries are spread out on sorting tables and inspected for defects. Any damaged, spoilt, immature or misshaped berries are removed manually. Berries that have not previously been destemmed, are diverted to destemming rollers.

Loading of berries on trays for IQF (optional)

Washed berries tend to stick together in large chunks when frozen with cryogenic freezers. This can be eliminated by loading the berries onto special trays that maintains the berries in spaced relation to each other while they are being frozen. At the same time, better drainage from the berries and improved circulation of the freezing medium is achieved. This precaution is not necessary for fluidised bed air-blast freezing.

Individual quick freezing of berries

Individual quick freezing (IQF) preserves the intrinsic characteristic of whole berries, causes less cellular damage and results in a firmer textured final product. The products can be frozen as loose pieces before packaging or in carton boxes. Pre-packaging freezing is preferred because it is faster. Individual quick-freezing can be done with fluidised bed air-blast freezers or with cryogenic freezers.

- Fluidised bed air-blast freezer: The product is frozen with air at -30 to -40 °C that is passed at high velocity (2 - 5 m/sec) up through a 3 - 14 cm thick bed of berries contained in a trough (V) with a perforated base. The product being frozen shows turbulent movement (like a liquid - free-flowing). Products are frozen within 3 - 15 minutes. The berries may be given a thin ice glaze to minimise freezer burn and clumping during freezing. This involves wetting the berries before passing it through the pre-chilling zone of the freezer so as to freeze a thin ice layer around each berry. The glazed berries are then moved onto the colder zone of the freezer to complete freezing

Loading berries.

Frozen berries

"Fluidised bed air-blast freezer: The product is frozen with air at -30 to -40 °C."

"Cryogenic freezer: This process involves freezing of food with liquefied or solidified gasses (refrigerants)."

- Cryogenic freezers: This involves freezing of food with liquefied or solidified gasses (refrigerants). Most common refrigerants are solid carbon dioxide and liquid nitrogen (boiling point of carbon dioxide is -79 °C and liquid nitrogen -196 °C). The refrigerant is in close contact with the food and rapidly removes energy from the food to absorb its latent heat of vaporisation or sublimation, to provide high heat transfer coefficients and rapid freezing. The choice of a refrigerant depends on the price and availability of the carbon dioxide and nitrogen. Liquid carbon dioxide is sprayed onto food to form a layer of snow on the product which evaporates (sublimates) on contact. In liquid-nitrogen freezers, packed or unpacked products are put on a perforated belt moving through a tunnel, where it is cooled by gaseous nitrogen and then frozen by liquid-nitrogen sprays. The temperature is allowed to equilibrate at the required storage temperature before it is removed from the freezer. Production rates from 45 - 1350 kg/h are possible. The use of a gaseous nitrogen freezer is advantageous because of its greater flexibility, relative low capital costs, smaller weight losses from dehydration of the product, rapid freezing, exclusion of oxygen during freezing, low power consumption and rapid start-up and no defrost time. The main disadvantage is the relatively high operating cost of replenishing the refrigerant.

Mixing of frozen berries (optional)

Different types of frozen berries and currants may be mixed together to produce interesting new product varieties. The combination of the various frozen berries used, depends on the end use of the product and the requirements set in *Regulations regarding control over the sale of frozen fruit and frozen vegetables in the Republic of South Africa, R727/1998.*

Packaging of individually quick frozen berries

Packaging is defined as the containment of a food product in a protective barrier that prepares goods for transport, distribution, storage, retailing and end-use.

The frozen berries are immediately packed into suitable containers and hermetically sealed. A great variety of packaging containers may be chosen from; provided the packaging material and seal are moisture proof and can withstand the frozen storage conditions. Suitable retail containers include polyethylene and polypropylene bags and tubs.Large quantities can be packed in drums or barrels, which can be either steel with a plastic lining or fiber drums. Cartons with a wax or plastic-lining (bag-in-box packaging) and an exterior protective overwrap can also be used. The packaged product should be stored at around -23 °C. Temperature fluctuations should be avoided since this reduces the storage life due to the rapid build-up of water on the internal surface of the package and subsequent clumping of the individual fruit.

Vacuum packaging would add to the preservation of the berry flavour and colour and thus extend the keeping quality of the product

Labelling of frozen fruit and vegetable products

Frozen fruit and vegetable products must be correctly labelled according to the requirements set out in the Regulations regarding control over the sale of frozen fruit and frozen vegetables in the Republic of South Africa.

Legislation for fruit products

Labelling in South Africa is controlled by legislation. Anyone who wants to use the information provided in this document must familiarise him/herself with all the applicable laws that apply to the producing, processing, manufacturing and storage of the products referred to in this document.

Other processing options

Listed below are other processing options for blueberries not covered in this report, but available from Eskom.

- **Blueberry concentrate** is produced through the evaporation of blueberry puree to reduce the water content. The concentrate may be aseptically packed or frozen to extend the storage life.
- **Blueberry jam** is produced from fresh or frozen blueberries, which are cooked with sugar to produce a syrup with the desired solids content. Upon cooling, the syrup forms a soft gel.
- **Blueberry jelly** is produced through the concentration and gelling of unsweetened blueberry juice or blueberry syrup.
- **Blueberry juice** is the pressed and pasteurised liquid derived from fresh or frozen blueberries

Energy Advisory Services

Eskom's role is to aid the client with basic information in the decision making process. Thereafter the Eskom Advisor will fulfil the role of energy advisor as part of the team that the farmer selects.

Optimise your energy use

Eskom's Energy Advisors, in regions across South Africa, offer advice to business customers on how to optimise their energy use by:

- Understanding their energy needs
- Understanding their electrical systems and processes
- Investigating the latest technology and process developments, including electric infrared heating and drying systems
- Analysing how to reduce energy investment costs
- Optimising energy use patterns in order to grow businesses and industries

Call 08600 37566, leave your name and number and request that an Energy Advisor in you region contacts you. Alternatively, e-mail an enquiry to **advisoryservice@eskom.co.za**.

Alternative funding:

Five alternative funding product offerings are available to help reduce your investment costs for new agro-processing or agro-beneficiation business or expand/improve an existing agro-processing or agro-beneficiation business.

For more info visit: http://www.eskom.co.za/sites/idm/Business/Pages/Alternativefunding.aspx

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